AMENDMENTS

IN THE SPECIFICATION

Please amend the "CROSS REFERENCE TO RELATED PATENT APPLICATION" section to the following:

This application is a divisional application of United States Patent Application No. 09/644,019, filed August 22, 2000, now issued as US Patent No. 6,646,522, which claims the benefit of United States Provisional Application Serial No. 60/150,618, filed August 24, 1999.

Please amend the paragraph on page 3, starting on line 21 as follows:

United States Patents No. 5,472,935 and 6,078,827 disclose coplanar waveguides in which conductors of high temperature superconducting material are mounted on a tunable dielectric material. The use of such devices requires cooling to a relatively low temperature. In addition, United States Patents No. 5,472,935 and 6,078,827 teach the use of tunable films of $SrTiO_3$, or (Ba, Sr)TiO_3 with high a ratio of Sr. ST and BST have high dielectric constants, which results in low characteristics impend[~~e~~]ance. This makes it necessary to transform the low impend[~~e~~]ance phase shifters to the commonly used 50 ohm impedance.

Please amend the sentence beginning on page 8, line 18 as follows:

However, the substrate can be other materials, such as $LaAlO_3$, sapphire, Al_2O_3 and other ceramics.

Please amend the sentence beginning on page 9, line 13 as follows:

However, the substrate can be other materials, such as $LaAlO_3$, sapphire, $A1_2\theta\underline{O_3}$ and other ceramic substrates.

Please amend the sentence beginning on page 12, line 24 as follows:

The thick film tunable dielectric layer can be deposited by standard thick, film process onto low dielectric loss and high chemical stability subtracts, such as MgO, $LaAlO_3$, sapphire, $A1_2\theta\underline{O_3}$, and a variety of ceramic substrates.

Please amend the sentence beginning on page 9, line 6 as follows:

Electrodes 82 and 84 are adjacent to tunable dielectric material 80~~also extend around the edges of the waveguide~~ as shown in FIG. 5.

Please amend the sentence beginning on page 10, line 29 as follows:

FIGs. 10 ~~and 11~~ shows how the microstrip 138 line transforms to the coplanar waveguide assembly 140.

Please amend the sentence beginning on page 10, line 30 as follows:

The conductor 142 (top plan view in FIG. 10 and cross section view in FIG. 11) is connected, for example by soldering or bonding, to a central conductor 146 (top plan view in FIG. 10 and cross section view in FIG. 11) of coplanar waveguide 148 (top plan view in FIG. 10~~ and cross section view in FIG. 11~~).

Please amend the sentence beginning on page 6, line 8 as follows:

FIG. 1 is a top plan view of a reflective phase shifter constructed on a tunable dielectric layer 46 in accordance with the present invention.

Please amend the sentence beginning on page 6, line 9 as follows:

FIG. 2 is a cross-sectional view of the phase shifter of FIG. 1, taken along line 2-2[.] and includes electrodes 66 and 68 which are separated from electrodes 82 and 84 respectively by gaps 86 and 88.

Please amend the sentence beginning on page 9, line 25 as follows:

FIG. 7 is a cross-sectional view of the phase shifter of FIG. 6, taken along line 7-7[.] and includes 50-ohm microstrip line 14 which further includes a first linear line 16 and two quarter-wave microstrip lines 18, 20, each with a characteristic impedance of about 70 ohm. The microstrip line 14 is mounted on a substrate 22 of material having a low dielectric constant. The two quarter-wave microstrip lines 18, 20 are transformed to coplanar waveguides (CPW) 24 and 26 and match the line 16 to coplanar waveguides 24 and 26.

Please amend the sentence beginning on page 18, line 23 as follows:

FIG. 4 is a top plan view of a 30 GHz coplanar waveguide phase shifter assembly 60 constructed in accordance with this invention[.] with coplanar waveguide 62 positioned on a layer of tunable dielectric material 80.

Please amend the sentence beginning on page 8, line 24 as follows:

FIG. 5 is a cross-sectional view of the phase shifter assembly 60 of FIG. 4, taken along line 5-5[.] with electrodes 66 and 68 separated from electrodes 82 and 84 respectively by gaps 86 and 88.

Please amend the paragraph beginning on page 9, line 25 as follows:

FIG. 7 is a cross-sectional view of the phase shifter of FIG. 6, taken along line 7-7. The waveguide line 102 of FIG. 7 has an input 104 and an output 106, and is positioned on the surface of a tunable dielectric layer 108. A pair of ground plane electrodes 110 and 112 are also positioned on the surface of the tunable dielectric material and separated from line 102 by gaps 114 and 116. The tunable dielectric layer 108 is positioned on a low loss substrate 118 similar to that described above. The circle near the middle of the phase shifter is a via 120 for connecting ground plane electrodes 110 and 112.

Please amend the paragraph beginning on page 10, line 3 as follows:

FIG. 8 is a top plan view of the phase shifter assembly 42 of FIG. 4 with a bias dome 130 of FIG. 9 added to connect the bias voltage to ground plane electrodes 66 and 68. As seen in FIG. 8, a 30 GHz coplanar waveguide phase shifter assembly 60 is constructed in accordance with this invention. Two tapered matching sections 76 and 78 are positioned at the ends of the waveguide and form impedance transformers to match the 20-ohm impedance to a 50-ohm impedance. Coplanar waveguide 62 is positioned on a layer of tunable dielectric material 80. FIG. 8 further illustrates an electrode termination 132 (also depicted in FIG. 9).

Please amend the paragraph beginning on page 10, line 5 as follows:

FIG. 9 is a cross-sectional view of the phase shifter assembly 60 of FIG. 8, taken along line 9-9[.] illustrating coplanar waveguide 62 positioned on a layer of tunable dielectric material 80. The tunable dielectric material 80 is positioned on a planar surface of a low dielectric constant (about 10) substrate 90. A metal holder 92 extends along the bottom and the sides of the waveguide.

Please amend the paragraph beginning on page 10, line 19 as follows:

FIG. 13 is an exploded isometric view of an array 170 of 30 GHz coplanar waveguide phase shifters constructed in accordance with the present invention, for use in a phased array antenna. A bias line plate 172 is used to cover the phase shifter array. The electrodes on the dome of each phase shifter are soldered to the bias lines on the bias line plate through the holes 174, 176, 178 and 180. The phase shifters are mounted in a holder 182 that includes a plurality of microstrip lines 184, 186, 188, 190, 192, 194, 196 and 198 for connecting the radio frequency input and output signals to the phase shifters. The particular structures shown in FIG. 13, provide each phase shifter with its own protective housing. The phase shifters are assembled and tested individually before being installed in the phased array antenna. This significantly improves yield of the antenna, which usually has tens to thousands phase shifters. Again, a housing 166 is built over the bias dome to cover the whole phase shifter such that only two 50 ohm microstrip lines are exposed to connect to an external circuit.

Please amend the sentence beginning on page 9, line 6 as follows:

Electrodes 82 and 84 ~~also~~ may extend around the edges of the waveguide although not depicted as such ~~as shown~~ in FIG. 5.